

**WHAT IS CLAIMED IS:**

1. A titanium dioxide film synthesizing method comprising the steps of:  
5 coating a titanium film on a surface of a substrate, and  
placing the titanium-coated substrate as anode in an electrolyte to synthesize  
an anatase phase of titanium dioxide film on a surface of said titanium film by  
employing electrochemical anodic oxidation.
- 10 2. The titanium dioxide film synthesizing method as claimed in claim 1,  
wherein said substrate is selected from a group of materials including titanium, glass,  
ceramics, polymers, and semiconductor such as silicon.
3. The titanium dioxide film synthesizing method as claimed in claim 1,  
15 wherein said titanium dioxide film is nano-structured.
4. The titanium dioxide film synthesizing method as claimed in claim 1,  
wherein said titanium film is deposited on said substrate by sputtering.
- 20 5. The titanium dioxide film synthesizing method as claimed in claim 1,  
wherein said titanium film is deposited on said substrate by evaporation.
6. The titanium dioxide film synthesizing method as claimed in claim 1,  
wherein said electrolyte is a highly alkaline solution containing alkaline metal ions.

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7. The titanium dioxide film synthesizing method as claimed in claim 6, wherein said electrolyte is selected from one of potassium hydroxide (KOH) and sodium hydroxide (NaOH).

5           8. The titanium dioxide film synthesizing method as claimed in claim 1, wherein the concentration of said electrolyte is within 0.1~10 M.

9. The titanium dioxide film synthesizing method as claimed in claim 1, wherein said electrochemical anodic oxidation is performed by using a  
10   potentiodynamic mode at voltage ranging from 30 V to 75 V.

10. The titanium dioxide film synthesizing method as claimed in claim 1, wherein said electrochemical anodic oxidation is performed by using a scanning electrolytic voltage mode at a scanning rate below 200 mV/s and a scanning cutoff  
15   voltage within 3 V to 85 V.

11. The titanium dioxide film synthesizing method as claimed in claim 1, wherein said electrochemical anodic oxidation is performed for a period of time within  
5 minutes to 10 hours.

20           12. The titanium dioxide film synthesizing method as claimed in claim 1, wherein said electrochemical anodic oxidation is performed at a working temperature within 15°C~90°C.

25           13. The titanium dioxide film synthesizing method as claimed in claim 1,

wherein said electrolyte is highly acid solution such as sulfuric acid ( $\text{H}_2\text{SO}_4$ ).

14. The titanium dioxide film synthesizing method as claimed in claim 1,  
further comprising the step of heating said anatase phase titanium dioxide film under  
5 atmospheric pressure for a predetermined length of time to transform said anatase  
phase titanium dioxide film to rutile phase titanium dioxide film.

15. The titanium dioxide film synthesizing method as claimed in claim 14,  
wherein said anatase phase titanium dioxide film is heated at  $500^\circ\text{C}$  for 2 hours.  
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16. A titanium dioxide film with single anatase phase has a nano-network  
structure.

17. The titanium dioxide film as claimed in claim 16, wherein an inner  
15 diameter of the network structure is ranging from 1~200 nm.

18. The titanium dioxide film as claimed in claim 16 being formed on a  
surface of a titanium film.

20 19. The titanium dioxide film as claimed in claim 18, wherein the titanium  
film is formed on a substrate.

20. A titanium dioxide film synthesizing method comprising the step of  
placing a titanium substrate as anode in an electrolyte to synthesize an anatase phase of  
25 titanium dioxide film on a surface of said titanium substrate by employing

electrochemical anodic oxidation.